Laser Safety and the National Ignition Facility

10th Annual Department of Energy LSO Workshop

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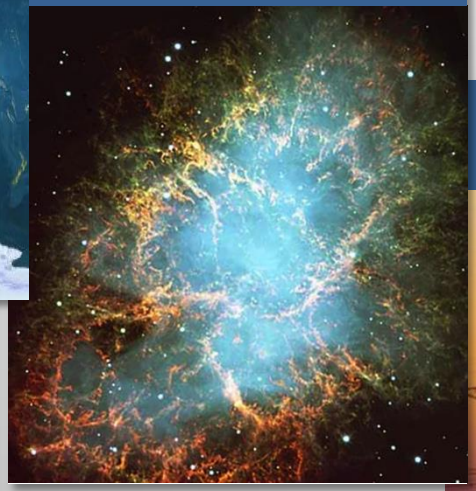
San Francisco
(45 mi.)
Lawrence Livermore National Laboratory
National
Ignition
Facility

NIF&PS Missions

The mission of NIF&PS is to maintain U.S. leadership, enhance national security, and prevent technological surprise through its development and application of photonics.

Ensuring Global Stability & Global Security

Advancing Frontier Science



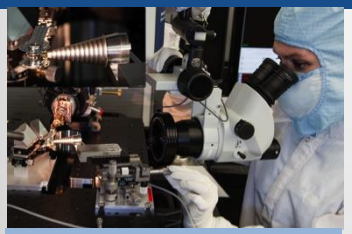
Enabling Clean Energy

Building Future Generations of HED Scientists

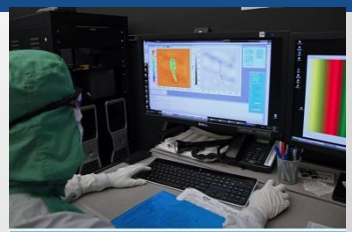
What constitutes NIF&PS?

Major Facilities


NIF


Target Fab


OPF


Grating Fab


Fiber Tower

Programs


ICF


E-23


DPAL


Fibers

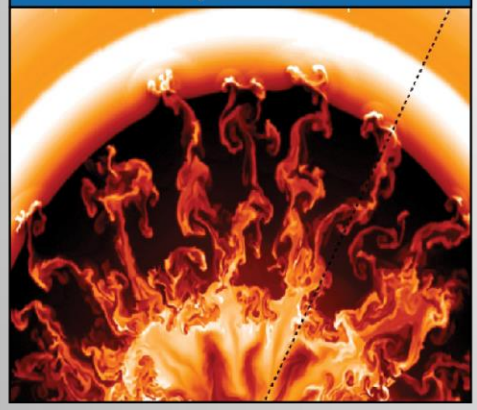
Developing Technologies for Future Programs


IFE


Compton Gamma Sources

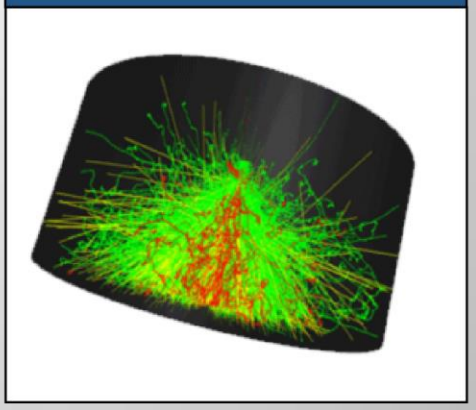
Compelling scientific questions that are being addressed at the NIF

How do supernovae explode?

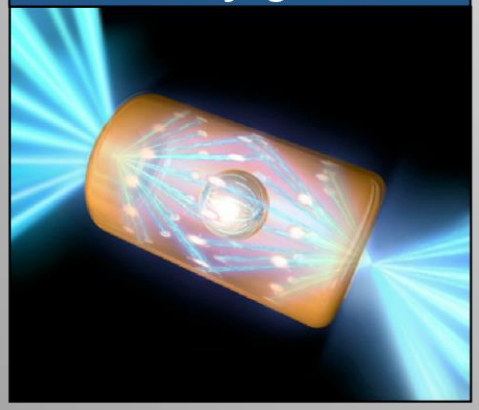


How do dust-filled nebulae (stellar nurseries) evolve?

How do gamma-ray bursts occur?

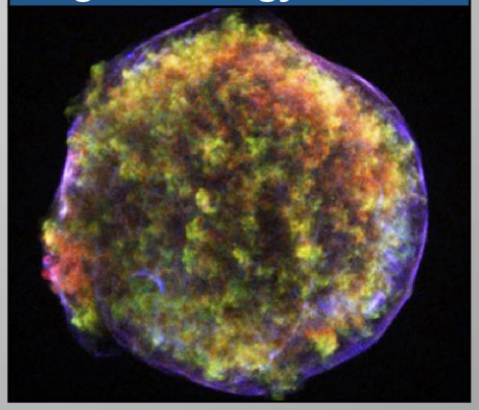


Can we demonstrate laboratory ignition?



Do giant planets contain "oceans of diamonds"?

What is the source of the highest-energy cosmic



The NIF laser is the culmination of a long line of LLNL systems

Janus, 1973

100 J IR

Argus, 1976

1 kJ IR

Shiva, 1977

10 kJ IR

Nova, 1984

30 kJ UV

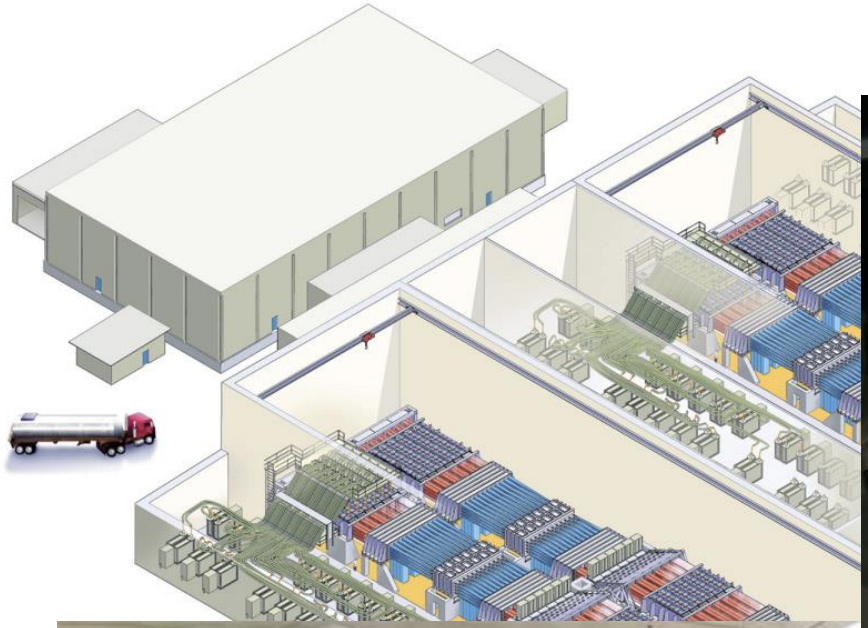
NIF, 2009

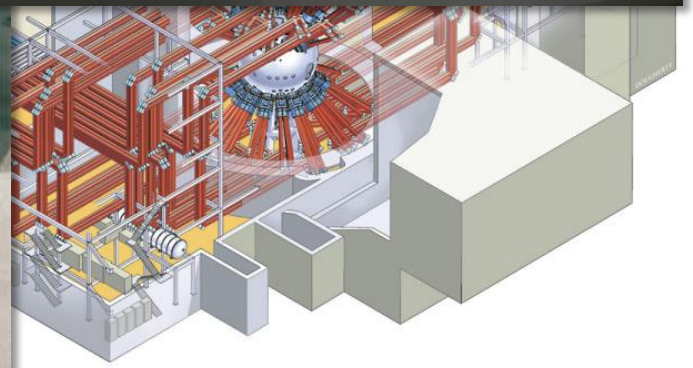
1.8 MJ UV

NIF concentrates all 192 laser beam energy in a football stadium-sized facility into a mm3

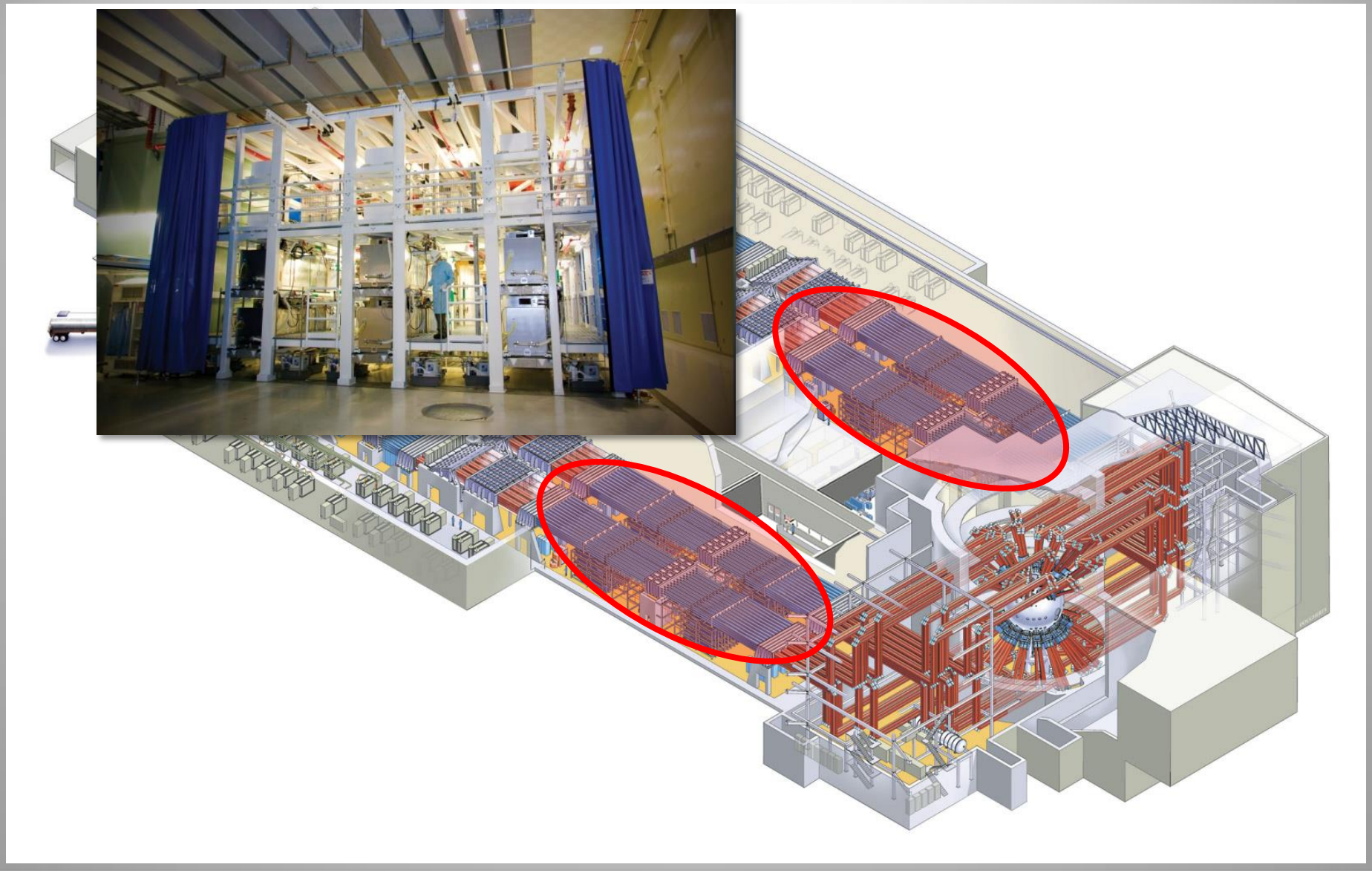
NIC

Master Oscillator Room (MOR)





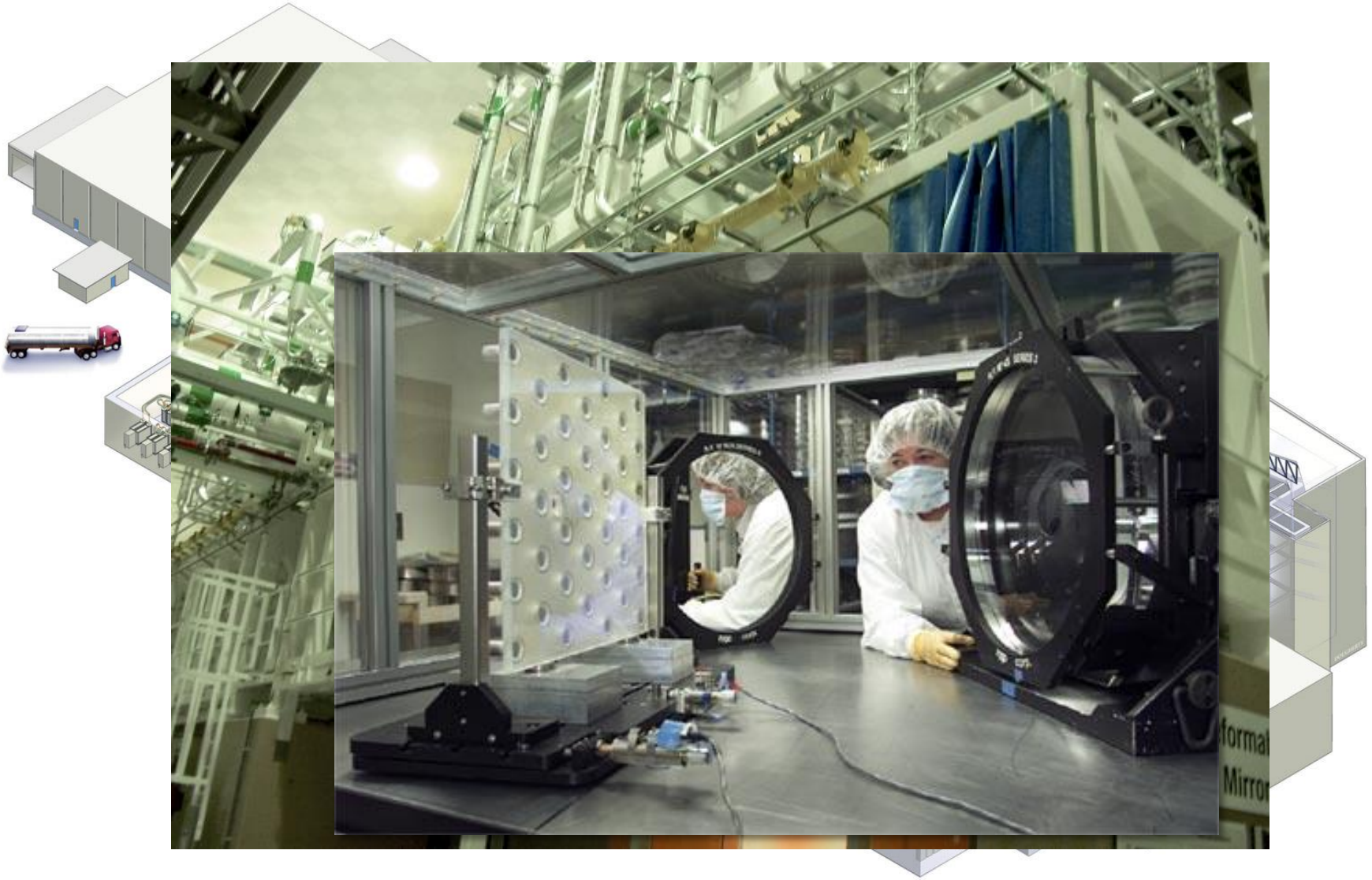
Preamplifier Modules (PAMs)



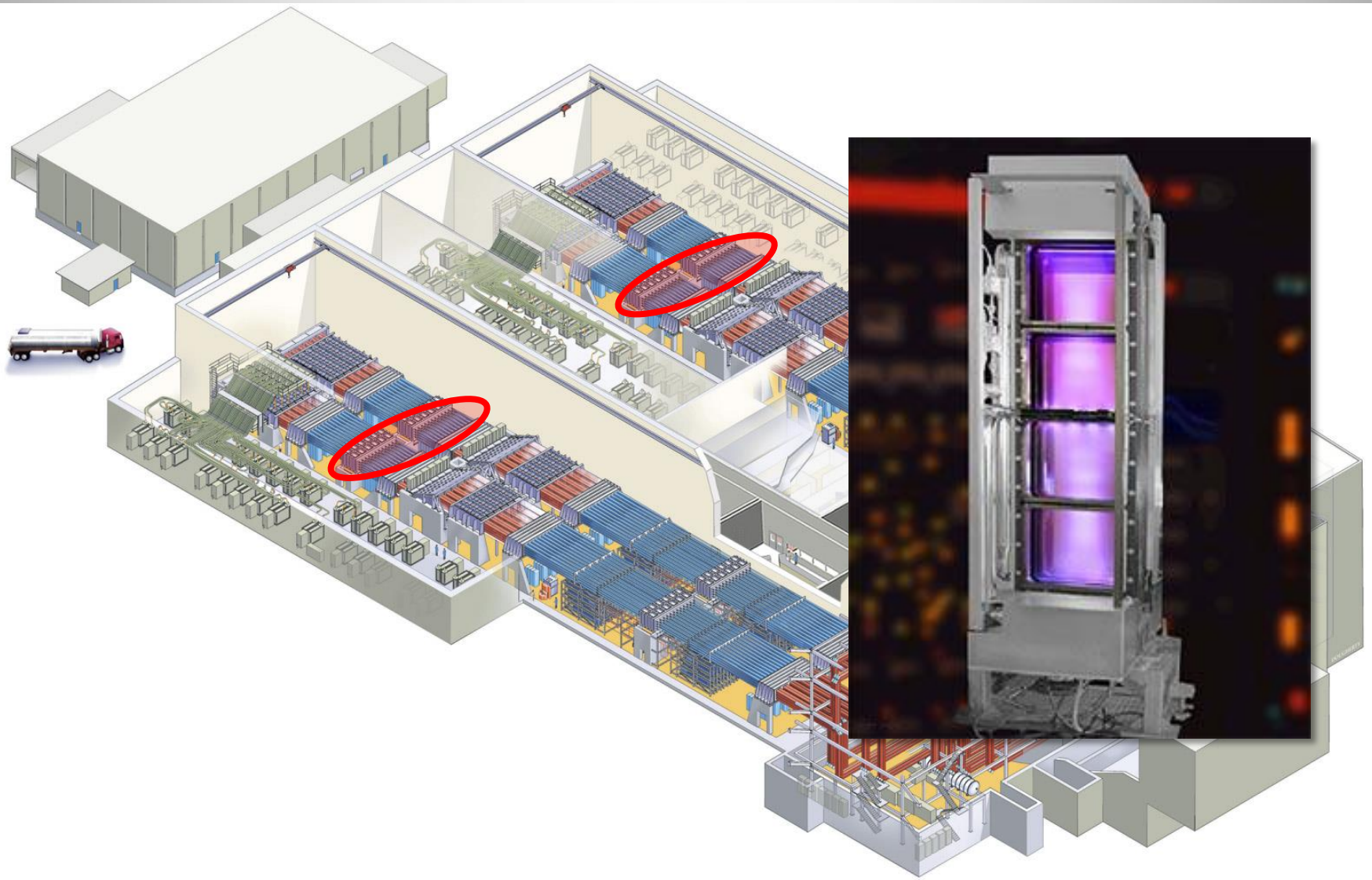
PAM Laser Safety

Amplifiers and Flashlamps

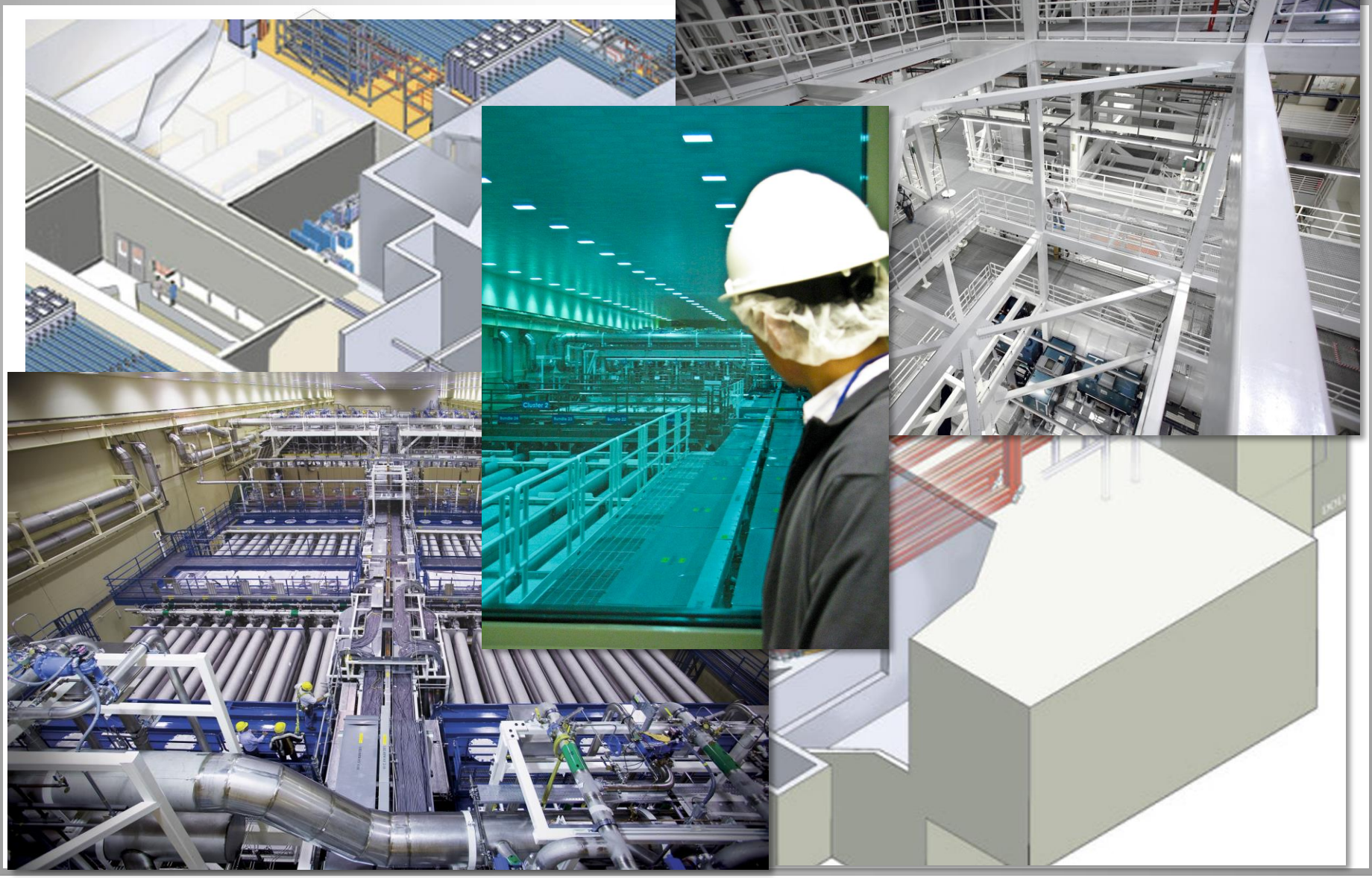
Deformable Mirror



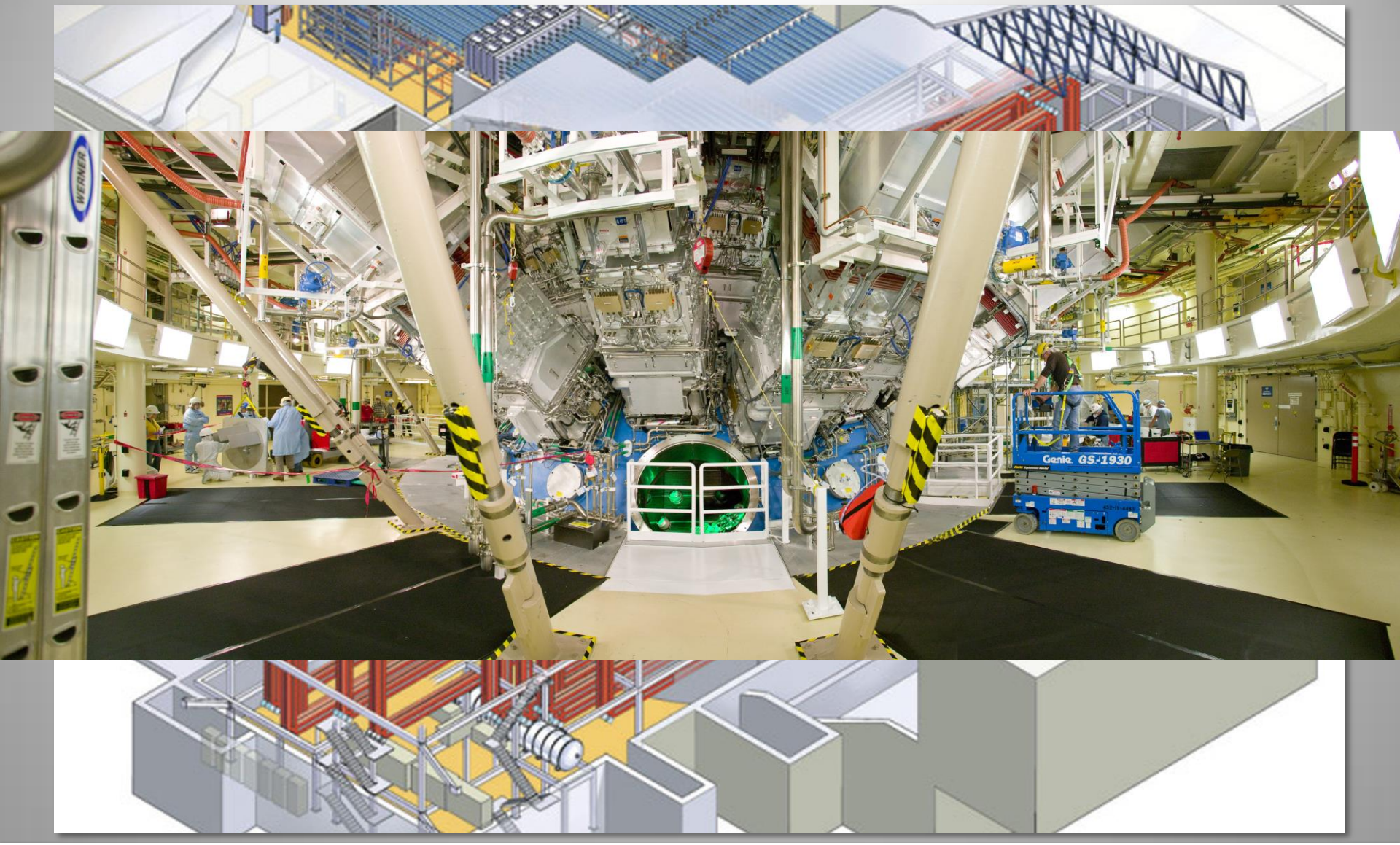
Plasma Electrode Pockels Cell (PEPC)



Beam Transport

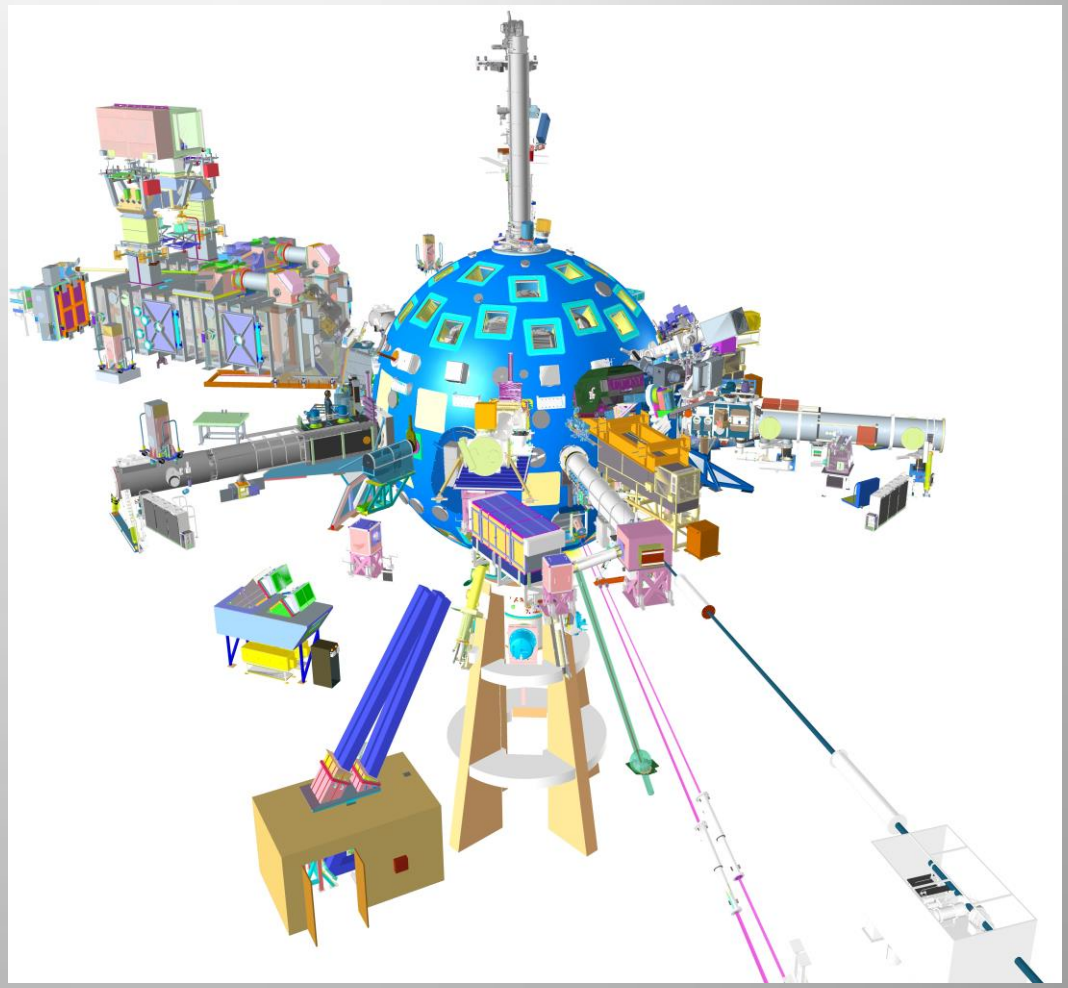


Target Chamber Bay



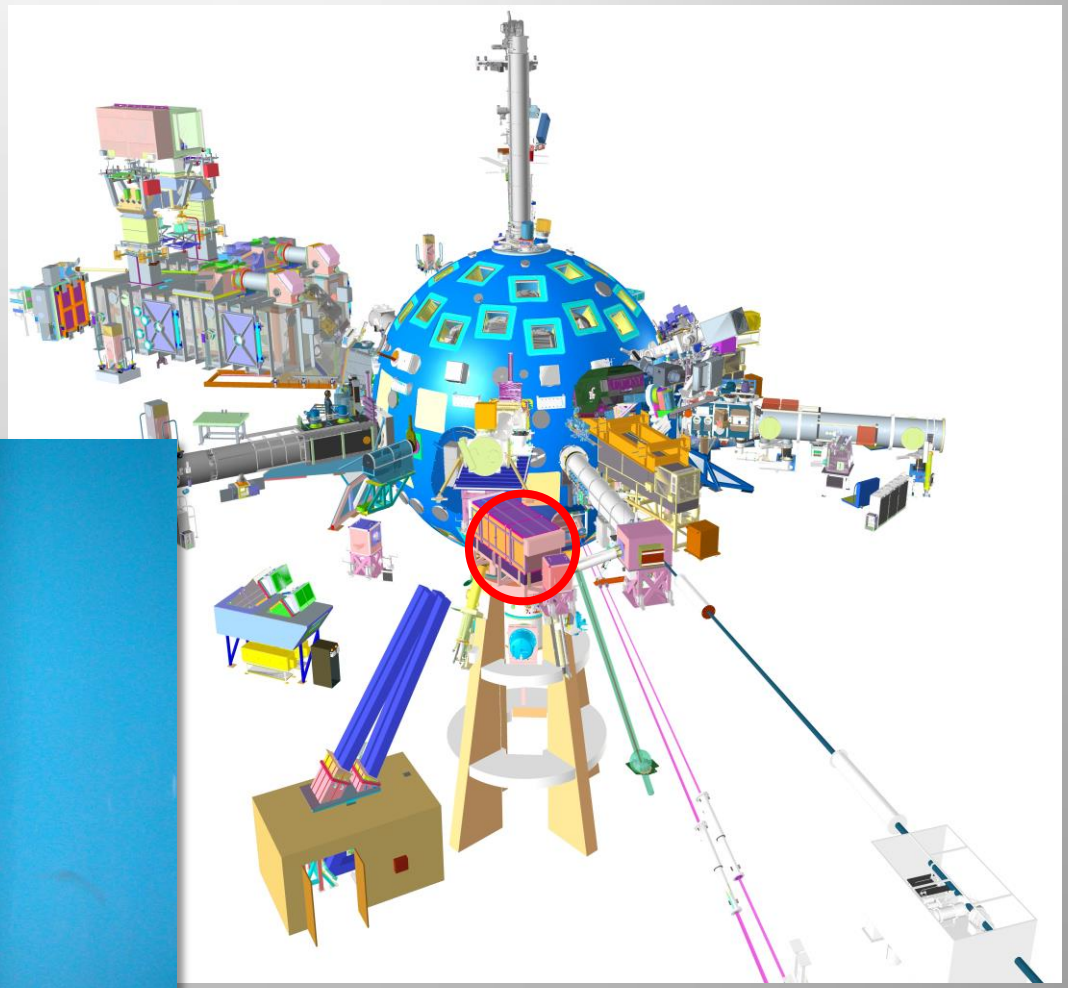
Diagnostic Lasers

- Diagnostic Lasers require additional controls because:
  - Generally High Powered (Class 3B and Class 4)
  - Can be operated independent of the NIF
  - Some present beam hazards far from source
- Velocity Interferometry for any Reflector (VISAR)
- Full Aperture Backscatter (FABS)
- Calibration Laser (LCAL)
- Advanced Radiographic Capabilities (ARC)
- Edge

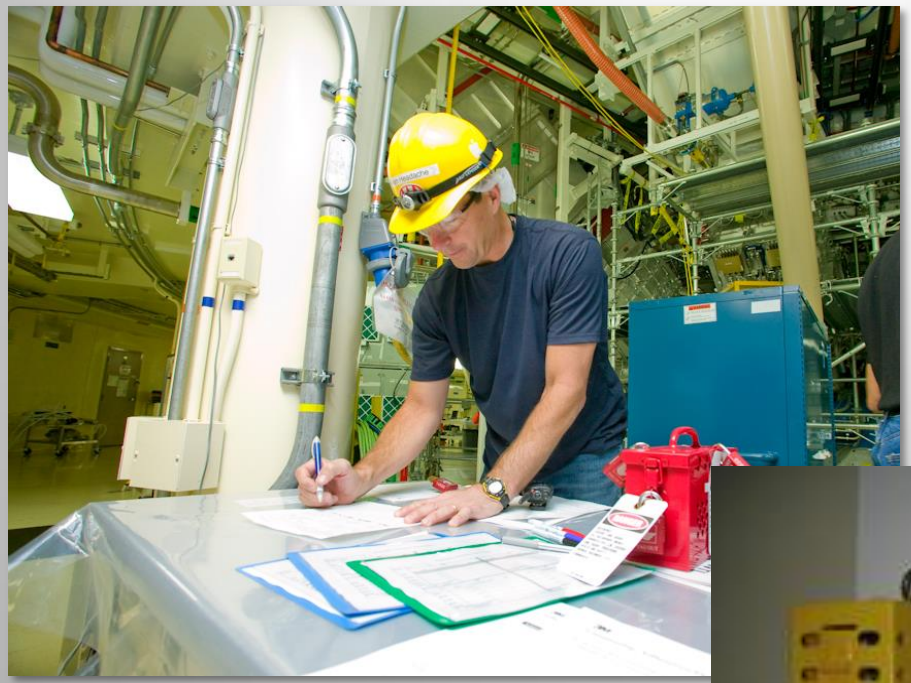


Diagnostic Lasers (cont')

- Laser Safety
  - Laser Safety Gram
  - Each diagnostic may have unique controls
  - Generally typical laser safety protocols in effect
- Some require custom controls

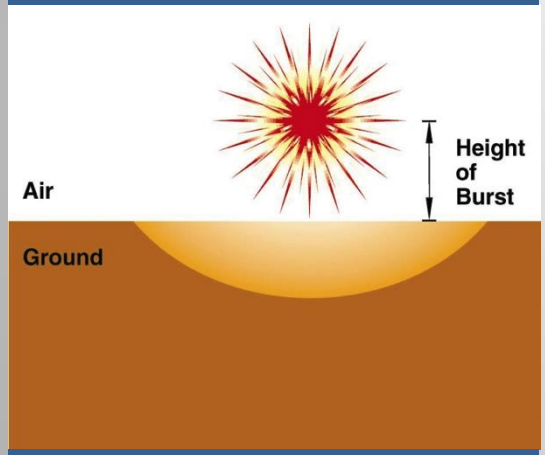


LOTO and Key Tree



NIF is having significant impact on broader national security questions

Nuclear Forensics



Highly successful EPEC experiments

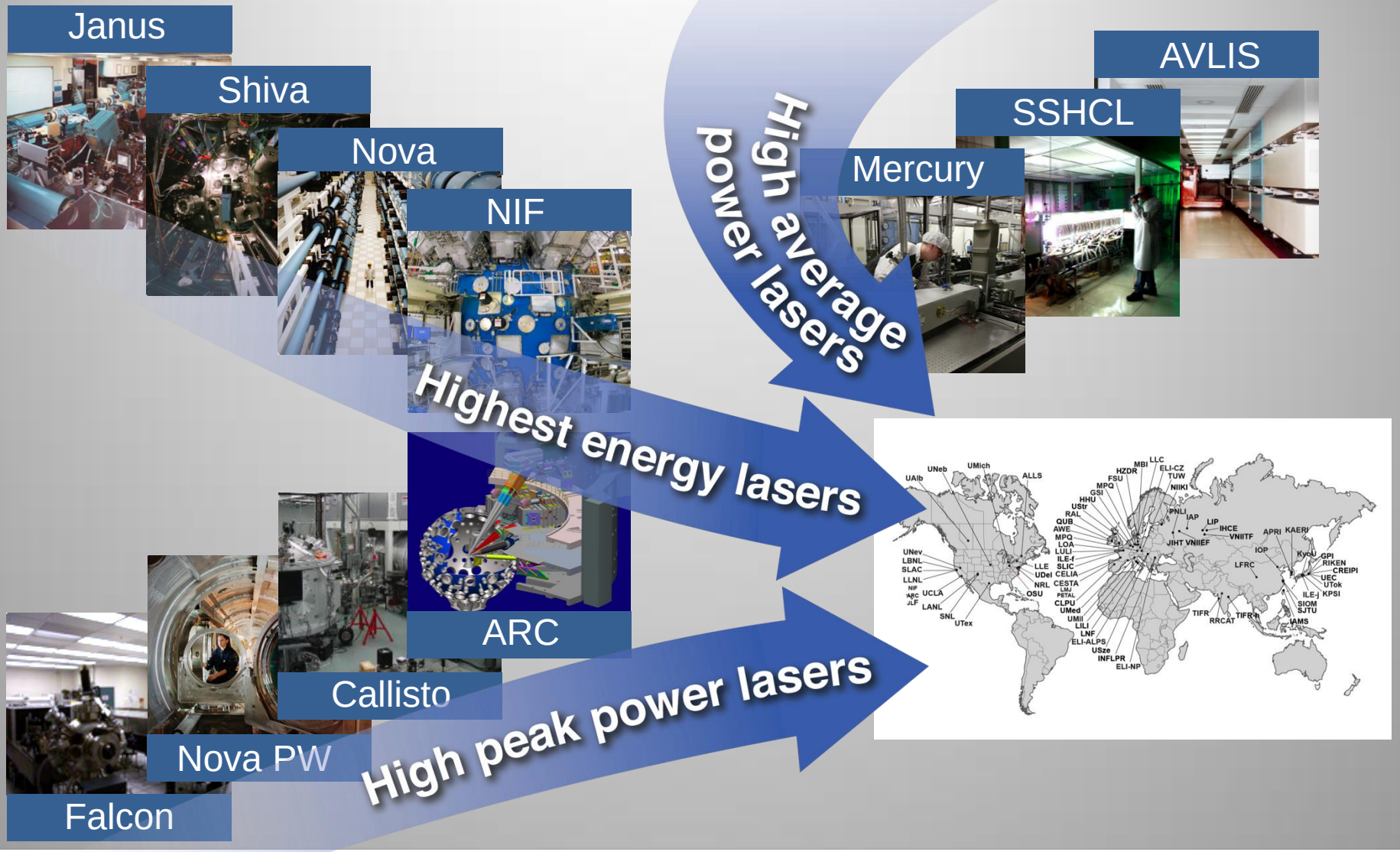
X-ray effects testing

2009/2010 optics tests

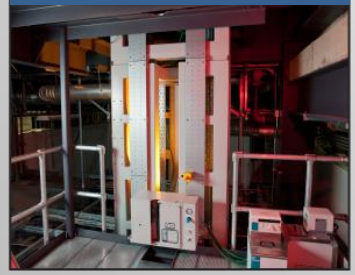
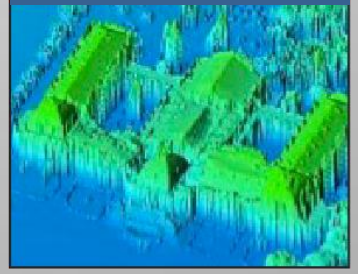
EMP

AWE/DTRA/LLNL/LSNL experiment in progress

Continued LLNL leadership in high peak power, high average power, and high energy lasers



NIF&PS should continue to lead in photonics technology

Sources	NIF 	E-23 	DPAL 	MEGa-ray 
Optics Innovation	Fibers 	Crystal 	Gratings 	Optics 
National Security Applications	SSP 	Directed Energy 	LIDAR 	Communications 

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